Homework #3
Due Date: Feb. 5, 2002

1. [10 each] Lim, Problems 3.2, 3.8, 3.11, 3.16

2. [100] In the problem you will write a 2D DCT programs using Matlab’s `fft2` and `ifft2`. Matlab has its own `dct2`, but you will write your own – the Matlab `dct2` is slightly different that which we discussed in class so you can’t use it exactly to debug your code. You will also look at the ability of the DCT and DFT
   a. Write the forward `dct_2` function using `dct_2_template.m`.
   b. Write the forward `idct_2` function using `idct_2_template.m`.
   c. Run the first half of `hw3_template.m` to validate the forward and reverse 2D DCT’s that you wrote. This part produces 4 images. Please label all images.
   d. Now, we will look at that information compression properties of the DCT.
      i. Break the image into 6 128x128 subimages (blocks).
      ii. Execute the 2D DCT on each block.
      iii. Retain a 32x32 block of data from the DCT of each, specifically let:
      
      \[
      C(x(k,l)) = \begin{cases} 
      C(x(k,l)) & k \leq 31, l \leq 31 \\
      0 & \text{otherwise}
      \end{cases}
      \]
      iv. Inverse 2D DCT each block and piece image together again.
   e. Do the same steps for the DFT. For part iii., keep an equivalent number of independent coefficients (note that DFT is complex, DCT is real).
   f. Compare the results for d. and e. Is DCT or DFT preferred for block processing of data? Hand in code and all figures.